Health Consultation

IBP INC./TIRE CHOP FACILITY
TARGETED BROWNFIELDS ASSESSMENT

1525 "O" AVENUE

FORT DODGE, WEBSTER COUNTY, IOWA

SEPTEMBER 25, 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

IBP INC./TIRE CHOP FACILITY
TARGETED BROWNFIELDS ASSESSMENT

1525 “O” AVENUE

FORT DODGE, WEBSTER COUNTY, IOWA

Prepared By:

Iowa Department of Public Health
Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Purpose

The Iowa Department of Natural Resources (IDNR) has requested the Iowa Department of Public Health (IDPH) Hazardous Waste Site Health Assessment Program to evaluate future health impacts of exposures at the formerly utilized IBP Inc./Tire Chop facility located at 1525 "O" Avenue, Fort Dodge, Iowa. This site has undergone a Targeted Brownfields Assessment conducted by the Contaminated Sites Section of the IDNR. This health consultation addresses potential health risks to people from future exposure to soil within the property boundary, and any health impacts resulting from contaminated groundwater beneath the site property from an evaluation of the data collected during the Targeted Brownfields Assessment. The information in this health consultation was current at the time of writing. Data that emerges later could alter this document's conclusions and recommendations.

Background

The site is located in the southern portion of Fort Dodge, Iowa about one-half mile west of the Des Moines River. The site consists of the former packing plant building, and three out-buildings on approximately six (6) acre. The rest of the site area is vegetated except for concrete parking areas on the north and west sites of the main building, concrete areas on the south side of the packing plant, and a gravel access road along the eastern side of the site. Figure 1, on page 8, is a 2006 aerial photo of the site.

The site was originally utilized in the 1950s as a beef slaughter and processing plant under the name Fort Dodge Beef Packers and later as Iowa Beef Packers. The site was utilized as a beef slaughter and processing plant until the mid-1980s. The site remained vacant for some time and then was used for a scrap tire storage and disposal site, with some tire shredding, from 1993 until 2000. The eastern 5 acres of the site was bought by Ponderosa Towing in 2003 (1).

In 2004 a Phase I Environmental Site Assessment (ESA) was completed that identified the following areas of concern: 1) solid waste handling vehicles, empty 55-gallon drums, and demolition debris, 2) an abandoned tank within the southeast portion of the main building that was used to burn materials for heat and the oily substance surrounding it, and 3) an abandoned aboveground storage tank on the site property located southwest of the main building. Based upon this Phase I ESA the IDNR developed a sampling plan and site evaluation to assess soil and groundwater contamination in these areas

Site Evaluation

IDNR personnel traveled to the site four times to complete site fieldwork. Electromagnetic ground conductivity surveying was completed on the southern end of the property to locate any buried tires on June 29, 2006. Soil conductivity data collection and installation of monitoring wells MW-1 and MW-2 were completed on July 19, 2006. Geoprobe® screen point sampling, installation of MW-3, well sampling and surveying of the wells were completed on July 26, 2006. Surface soil (the top 0-6 inches) sampling was completed on August 15-16, 2006. Over

the course of the evaluation a total of 53 soil samples and 5 groundwater samples were collected. Tables A-1 and A-2 in the appendix include the results of the soil and groundwater sample analysis completed during the evaluation. These tables only include the chemicals that were detected in the collected samples. These tables also indicate comparison values, if they are available, for each of the detected chemicals. Comparison values are calculated concentrations of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects even in the most sensitive portions of the population. Comparison values are determined through human or animal health studies and may be adjusted by safety factors, which account for uncertainty, such as variation in people's sensitivity to chemical exposures and differences between the animals used in studies and humans. The comparison values included in the following tables have been developed by either the Agency for Toxic Substances and Disease Registry (ATSDR) or the U.S. Environmental Protection Agency (EPA).

Chemicals of Concern

The chemicals of concern at the site, which are further discussed in this health consultation, are the contaminants detected within the soil and groundwater samples that were above comparison values. Table 1, below, lists the chemicals detected in the soil and groundwater samples that were present above comparison values.

Table 1 – Soil and Groundwater Contaminants Detected Above Comparison Values

Sample ID (Media) (Depth)	Chemical Parameter	Concentration	Comparison Value (Reference Source)
A-2 (Soil) (0-6 inches)	Antimony	59 mg/kg	20 mg/kg (EPA)
A-3 (Soil) (0-6 inches)	Antimony	74 mg/kg	20 mg/kg (EPA)
A-5 (Soil) (0-6 inches)	Antimony	84 mg/kg	20 mg/kg (EPA)
A-6 (Soil) (0-6 inches)	Antimony	68 mg/kg	20 mg/kg (EPA)
A-13 (Soil) (0-6 inches)	Antimony	61 mg/kg	20 mg/kg (EPA)
B-3 (Soil) (0-6 inches)	Antimony	60 mg/kg	20 mg/kg (EPA)
B-5 (Soil) (0-6 inches)	Antimony	140 mg/kg	20 mg/kg (EPA)
	Cadmium	23 mg/kg	10 mg/kg (ATSDR)
B-8 (Soil) (0-6 inches)	Antimony	112 mg/kg	20 mg/kg (EPA)
C-5 (Soil) (0-6 inches)	Antimony	73 mg/kg	20 mg/kg (EPA)
C-8 (Soil) (0-6 inches)	Antimony	93 mg/kg	20 mg/kg (EPA)
C-14 (Soil) (0-6 inches)	Antimony	133 mg/kg	20 mg/kg (EPA)
F-14 (Soil) (0-6 inches)	Antimony	71 mg/kg	20 mg/kg (EPA)
G-2 (Soil) (0-6 inches)	Antimony	119 mg/kg	20 mg/kg (EPA)

Table 1 (Cont.) – Soil and Groundwater Contaminants Detected Above Comparison Values

Sample ID (Media) (Depth)	Chemical Parameter	Concentration	Comparison Value
G-3 (Soil) (0-6 inches)	Antimony	130 mg/kg	20 mg/kg (EPA)
G-4 (Soil) (0-6 inches)	Antimony	57 mg/kg	20 mg/kg (EPA)
G-11 (Soil) (0-6 inches)	Antimony	110 mg/kg	20 mg/kg (EPA)
G-14 (Soil) (0-6 inches)	Antimony	108 mg/kg	20 mg/kg (EPA)
BSS-1 (Soil) (0-6 inches)	Antimony	88 mg/kg	20 mg/kg (EPA)
FTBS (Soil) (0-6 inches)	Antimony	85 mg/kg	20 mg/kg (EPA)
MW-2 (Groundwater)	Vinyl Chloride	2.7 µg/L	2 µg/L (EPA)

Some of the detections of chemicals in site soil were fairly high, such as iron, calcium, and potassium. Although these chemicals are present in much large amounts that antimony or cadmium, there are no adverse health effects if these chemicals are consumed in larger quantities. This is reflected in the literature.

Discussion

Exposure to Chemicals of Concern

Exposure to the chemicals of concern at the formerly utilized IBP Inc./Tire Chop facility is determined by examining human exposure pathways. An exposure pathway has five parts:

1. a source of contamination,
2. an environmental medium such as air, water, or soil that can hold or move the contamination,
3. a point at which people come in contact with a contaminated medium, such as, in drinking water, or in surface soil,
4. an exposure route such as, drinking water from a well, or eating contaminated soil on homegrown vegetables, and
5. a population who could come in contact with the contaminants.

An exposure pathway can be eliminated if at least one of the five parts is missing and will not occur in the future. For a completed pathway, all five pathway parts must exist and exposure to a contaminant must have occurred, is occurring, or will occur.

Exposure to Groundwater

Exposure to any contaminated groundwater from the site would be possible if individuals were drinking water supplied by wells located in the vicinity of the site that obtained water from the same source as the contamination was located. The nearest public water supply wells are located approximately 6000 feet to the northwest of the site (2). According to the IDNR (G. Fuhrman,

IDNR, Contaminated Sites Section, email communication, April 3, 2007) there are residences located to the north of the site, and these residences are located up gradient to the site and connected to public water. And according to the IDNR (G. Fuhrman, IDNR, Contaminated Sites Section, email communication, April 4, 2007) there are no wells located down gradient or south from the site to the Des Moines River. Since there are no private wells located in the vicinity of the site the exposure pathway from site contaminants through groundwater to nearby private wells can be eliminated.

Exposure to Soils

Exposure to soils at the site will be possible through incidental ingestion of the soils from exposure to dust and from hand to mouth activities. According to the IDNR, the site is zoned for light industrial and commercial uses and will be most likely developed for this type of use. As a result, the site is not anticipated to be utilized for residential use in the future. Future exposure to site soils will mostly be limited to the top several inches of surface soil. The surface soil sampling completed at the site during the site evaluation was composite sampling, obtained from 0 to 6 inches below the ground surface, and is considered to be representative of the soil that a future site worker may be exposed.

Toxicological Evaluation

The following information has been prepared as a toxicological evaluation of exposure to the chemicals of concern in surface soils at the maximum detected concentration in surface soil samples collected at the site. In order to complete a realistic toxicological evaluation of exposure to site contaminants it is necessary to estimate realistic exposure levels to site soils. Exposure levels are related to site usage and the frequency of exposure to surface soils by individuals who regularly have access to the site.

Exposure Levels

The greatest potential for exposure to site contaminants would be from incidental ingestion of surface soils by individuals that would be regularly working at this site during and after it has been developed for light industrial or commercial use. Exposure to children (the most sensitive portion of the population) at this site will be extremely limited since the site is not anticipated to be utilized for residential use. Exposure estimates included in this health consultation will be limited to exposure to adult workers that may have daily exposure to site surface soils, as these individuals represent the ones with the greatest realistic ongoing potential for exposure.

The amount of soil a worker at the site would incidentally ingest on a daily basis can be estimated. The US EPA has completed research on many exposure factors and included this information in their Exposure Factors Handbook (3). Within this handbook is a section on incidental ingestion of soil. According to this handbook, an adult involved in gardening activities would incidentally ingest approximately 20 mg/hour of soil. It is anticipated that most workers at the site will not be conducting activities that involve soil exposure as intensive as gardening. It is assumed that an average adult incidentally ingests 100 mg/day or approximately 4 mg/hour from all sources of soil (indoor and outdoor). Therefore, the incidental ingestion of soil of 20 mg/hour from the outside portions of the site property is most likely an over-

estimation. A site worker completing 7 hours of outside duties may ingest up to 140 mg of soil per day of site surface soil.

Utilizing the data collected during the site evaluation an estimate can be made as to the amount of the chemicals of concern that an adult working at the site may be exposed. The maximum concentration of chemicals of concern detected in site soils are: 140 mg/kg of antimony and 23 mg/kg of cadmium. If we assume that an average adult weighs 70 kg, then the estimated amount of antimony incidentally ingested on a per kilogram per day basis is calculated as shown below:

(Ingestion Rage x Contaminate Concentration in Soil) / Body Weight

$$\frac{140 \text{ mg soil}}{\text{day}} \times \frac{\text{kg soil}}{10^6 \text{ mg soil}} \times \frac{140 \text{ mg Sb}^*}{\text{kg soil}} \times \frac{1}{70 \text{ kg}} = 2.8 \times 10^{-4} \text{ mg Sb/kg/day}$$

* Sb is the chemical symbol for antimony

A similar calculation can be used to estimate the amount of cadmium a site worker may ingest on a per kilogram per day basis. The following table displays an estimate of the antimony and cadmium incidentally ingested by a worker at the site.

Table 2 –Estimated Incidentally Ingested Chemicals of Concern

Contaminant	Maximum Concentration in Surface Soil (mg/kg)	Estimated Ingestion (mg/kg/day)
Antimony	140	2.8×10^{-4}
Cadmium	23	4.6×10^{-5}

This toxicological evaluation will compare this estimated daily ingestion amount to the following comparison values: ATSDR Oral Minimum Risk Levels (MRLs), the EPA Chronic Oral Reference Dose (RfD), and the level of exposure that translates to a one-in-ten-thousand (10^{-4}) increased risk of cancer utilizing an EPA oral slope factor.

Minimum Risk Levels

Minimum risk levels (MRLs) are established by the Agency for Toxic Substances and Disease Registry (ATSDR). The MRL is defined as, "an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. (4)." MRLs are based upon human and animal studies, include several safety factors, and are reported for acute exposure ($\leq$ 14 days), intermediate exposure (15 – 364 days), and chronic exposure ($\geq$ 365 days). The MRL for chronic oral exposure to cadmium is 2×10^{-4} mg/kg/day (4). MRLs for oral exposure to antimony are not available.

Chronic Oral Reference Dose

The EPA chronic oral RfD is defined as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive

subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (5)." The chronic oral RfDs are based upon human and animal studies, include safety factors, and are reported for lifetime exposures. The chronic oral RfD for antimony is 4×10^{-4} mg/kg/day (6). The chronic oral RfD for cadmium is 1×10^{-3} mg/kg/day (non-water exposures) (7).

Increased Risk of Cancer

The EPA has developed oral slope factors for evaluating increased risk of cancer from a lifetime of exposure to certain chemicals. The slope factor is defined as "An upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100. (8)." Oral slope factors have not been established for antimony or cadmium. While cadmium is carcinogenic by inhalation, levels above the comparison value were only found in one surface soil sample; therefore, it is not likely that cadmium within airborne particulate matter will be at a level of health concern.

Potential Health Impacts from Exposure to Chemicals of Concern

The first step in evaluating potential health impacts from exposure to chemicals of concern at the site is to determine the potential of adverse health impacts from exposures to areas of the site where the chemicals of concern are at their highest concentrations. The exposure estimates included in Table 4 utilize the highest level of soil contamination detected during the site evaluation completed by the IDNR.

Exposure to Highest Levels of Antimony in Soil

The estimated highest level of ingestion exposure to antimony in soil shown in Table 4 (2.3×10^{-4} mg/kg/day) is lower than the chronic oral RfD for antimony (4×10^{-4} mg/kg/day).

Exposure to Highest Levels of Cadmium in Soil

The estimated highest level of ingestion exposure to cadmium in soil shown in Table 4 (4.6×10^{-5} mg/kg/day) is lower than both the chronic oral exposure MRL (2×10^{-4} mg/kg/day) and the chronic oral RfD (1×10^{-3} mg/kg/day) for cadmium.

At the present time it is concluded that there are no areas of the site that have the potential of causing adverse health impacts due to exposure to antimony or cadmium in the soil. This conclusion is based on the finding that the site is being used exclusively for light industrial or commercial activities.

Children's Health Concerns

Children have unique vulnerabilities to some environmental chemicals, and IDPH's Hazardous Waste Site Health Assessment Program evaluated the potential impact of the presence of the chemicals of concern detected in the soil samples collected during the site evaluation on children's health. It is anticipated that children have not been exposed to site soils on a regular basis in the past, and since residential development is not proposed for the site, it is concluded

that children's health would not be negatively impacted by the presence of these chemicals at the levels detected within the soil samples. If the proposed use of the site would be changed to residential use, then an evaluation of children's health concerns would be warranted.

Community Health Concerns

The IDPH is aware that there are concerns about the health impacts to future workers at the site. The levels of all chemicals detected in the site soil suggest that the site, as it exists now, does not pose any human health risks to future employees working at the site.

Conclusions

From evaluating the soil and groundwater sampling and analytical data collected during the June, July, and August 2006 sampling events and other background information on the site it is concluded that:

- The formerly utilized IBP Inc./Tire Chop facility will not be a public health hazard (no apparent public health hazard classification) due to the exposure of site soils through incidental ingestion of site soils by any future employees working at the site. This applies only if the site is used for light industry and not for residential properties.

- It is anticipated that individuals working at the site or living close to the site will not be exposed to any contaminated groundwater. Residents in the area are supplied with water from the City of Fort Dodge Water Supply, which does not have a potential of being impacted by site contamination. In addition, there are no private wells located in the vicinity of the site.

Recommendations

- Additional private wells for potable use should not be installed in the vicinity of the site.

- The proposed use of the site should remain light industrial or commercial.

Public Health Action Plan

- IDPH will provide assistance with community health education as needed and requested.

- IDPH will continue to review additional sampling and analytical data provided by the IDNR or others and update health recommendations as necessary.

- IDPH will work with the IDNR and the local community to provide a mechanism the no water supply wells are installed within the site and that appropriate zoning is maintained.

Figure 1

References

1. Site Specific Assessment Conducted by the Iowa Brownfield Redevelopment Program at the IBP Inc./Tire Chop Facility, Iowa Department of Natural Resources, Des Moines, Iowa, March, 2007.

2. Surface Water Protection Evaluation – City of Fort Dodge, Iowa Department of Natural Resources, Des Moines, Iowa, April, 2003.

3. Exposure Factors Handbook: US Environmental Protection Agency; August 1997. EPA Web Link: http://www.epa.gov/ncea/efh/pdfs/efh-front-gloss.pdf

4. Minimum Risk Levels (MRLs) for Hazardous Substances, ATSDR Web Link: http://www.atsdr.cdc.gov/mrls.html

5. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/gloss8.htm#r

6. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/subst/0006.htm#reforal

7. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/subst/0141.htm#reforal

8. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/gloss8.htm#s

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CERTIFICATION

The Iowa Department of Public Health, Hazardous Waste Site Health Assessment Program, has prepared this health consultation evaluating site information and soil and groundwater sampling data at the formerly utilized IBP Inc./Tire Chop facility in Fort Dodge, Iowa under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The document is in accordance with approved methodology and procedures existing when the health consultation was being prepared. Editorial review was completed by the Cooperative Agreement Partner.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAT, SPAB, DHAC, ATSDR

Appendix

Table A-1 – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
A-1 (0-6 in.)	Strontium	93	4,000
	Rubidium	46	NA
	Lead	13	400
	Zinc	75	20,000
	Copper	42	500
	Iron	14,470	NA
	Manganese	296	3,000
	Vanadium	62	200
	Titanium	1,749	NA
	Scandium	120	NA
	Calcium	12,803	NA
	Potassium	7,705	NA
A-2 (0-6 in.)	Antimony	59	20
	Silver	33	300
	Strontium	92	4,000
	Rubidium	43	NA
	Arsenic	19	20
	Zinc	69	20,000
	Nickel	70	1,000
	Iron	20,874	NA
	Manganese	648	3,000
	Vanadium	50	200
	Titanium	1,650	NA
	Scandium	223	NA
	Calcium	24,714	NA
	Potassium	7,950	NA
A-3 (0-6 in.)	Antimony	74	20
	Silver	37	300
	Strontium	112	4,000
	Rubidium	35	NA
	Arsenic	10	20
	Zinc	180	20,000
	Copper	55	500
	Iron	17,311	NA
A-3 (0-6 in.)	Manganese	732	3,000
	Vanadium	47	200
	Titanium	1,300	NA
	Scandium	340	NA
	Calcium	35,957	NA
	Potassium	6,897	NA
A-4 (0-6 in.)	Strontium	81	4,000

NA means there is no applicable comparison value for that particular chemical parameter.

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
A-4 (0-6 in.)	Rubidium	41	NA
	Lead	14	400
	Zinc	2,619	20,000
	Copper	37	500
	Cobalt	215	500
	Iron	19,382	NA
	Manganese	532	3,000
	Vanadium	57	200
	Titanium	1,695	NA
	Scandium	197	NA
	Calcium	17,888	NA
	Potassium	7,734	NA
A-5 (0-6 in.)	Antimony	84	20
	Silver	57	300
	Strontium	81	4,000
	Rubidium	35	NA
	Lead	13	400
	Arsenic	7	20
	Zinc	77	20,000
	Copper	45	500
	Nickel	78	1,000
	Iron	14,500	NA
	Manganese	397	3,000
	Vanadium	64	200
	Titanium	1,930	NA
	Scandium	230	NA
	Calcium	26,662	NA
	Potassium	7,973	NA
A-6 (0-6 in.)	Antimony	68	20
	Strontium	106	4,000
	Rubidium	33	NA
	Lead	12	400
	Arsenic	9	20
	Zinc	47	20,000
	Iron	10,740	NA
	Manganese	536	3,000
	Vanadium	39	200
	Titanium	980	NA
	Scandium	589	NA
	Calcium	64,211	NA
	Potassium	5,459	NA
A-7 (0-6 in.)	Strontium	87	4,000
	Rubidium	32	NA
	Lead	13	400
	Zinc	52	20,000

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
A-7 (0-6 in.)	Iron	10,670	NA
	Manganese	466	3,000
	Vanadium	51	200
	Titanium	1,404	NA
	Scandium	315	NA
	Calcium	38,778	NA
	Potassium	6,420	NA
A-8 (0-6 in.)	Strontium	85	4,000
	Rubidium	32	NA
	Lead	12	400
	Arsenic	8	20
	Zinc	53	20,000
	Iron	10,585	NA
	Manganese	297	3,000
	Vanadium	42	200
	Titanium	1,107	NA
	Scandium	435	NA
	Calcium	46,778	NA
	Potassium	5,582	NA
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A-9 (0-6 in.)	Strontium	78	4,000
	Rubidium	40	NA
	Lead	12	400
	Zinc	54	20,000
	Copper	31	500
	Iron	13,726	NA
	Manganese	308	3,000
	Vanadium	56	200
	Titanium	1,794	NA
	Scandium	150	NA
	Calcium	17,799	NA
	Potassium	7,076	NA
A-10 (0-6 in.)	Strontium	94	4,000
	Rubidium	32	NA
	Arsenic	8	20
	Zinc	44	20,000
	Iron	12,715	NA
	Manganese	298	3,000
	Vanadium	44	200
	Titanium	1,411	NA
	Scandium	331	NA
	Calcium	35,410	NA
	Potassium	6,577	NA
A-11 (0-6 in.)	Strontium	87	4,000
	Rubidium	46	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)

A-11 (0-6 in.)	Lead	11	400
	Zinc	64	20,000
	Copper	44	500
	Iron	14,179	NA
	Manganese	382	3,000
	Vanadium	56	200
	Titanium	1,785	NA
	Scandium	151	NA
	Calcium	13,808	NA
	Potassium	7,034	NA
A-12 (0-6 in.)	Strontium	80	4,000
	Rubidium	46	NA
	Lead	13	400
	Zinc	88	20,000
	Iron	13,823	NA
	Manganese	356	3,000
	Vanadium	46	200
	Titanium	1,622	NA
	Scandium	81	NA
	Calcium	14,802	NA
	Potassium	6,702	NA
A-13 (0-6 in.)	Antimony	61	20
	Strontium	90	4,000
	Rubidium	49	NA
	Zinc	57	20,000
	Iron	16,024	NA
	Manganese	372	3,000
	Vanadium	45	200
	Titanium	1,369	NA
	Scandium	145	NA
	Calcium	10,108	NA
	Potassium	5,430	NA
A-14 (0-6 in.)	Strontium	92	4,000
	Rubidium	44	NA
	Lead	19	400
	Zinc	64	20,000
	Copper	36	500
	Iron	15,584	NA
	Manganese	474	3,000
	Vanadium	57	200
	Titanium	1,663	NA
	Scandium	148	NA
	Calcium	10,638	NA
	Potassium	6,600	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
A-15 (0-6 in.)	Strontium	85	4,000
	Rubidium	44	NA
	Arsenic	7	20
	Zinc	80	20,000
	Iron	14,887	NA
	Manganese	418	3,000
	Vanadium	64	200
	Titanium	1,854	NA
	Scandium	136	NA
	Calcium	11,533	NA
	Potassium	6,875	NA
B-2 (0-6 in.)	Strontium	109	4,000
	Rubidium	38	NA
	Lead	20	400
	Zinc	77	20,000
	Iron	14,588	NA
	Manganese	523	3,000
	Vanadium	37	200
	Titanium	1,125	NA
	Scandium	151	NA
	Calcium	17,186	NA
	Potassium	8,040	NA
B-3 (0-6 in.)	Antimony	60	20
	Silver	33	300
	Strontium	120	4,000
	Rubidium	43	NA
	Lead	12	400
	Zinc	89	20,000
	Iron	16,463	NA
	Manganese	449	3,000
	Vanadium	59	200
	Titanium	1,668	NA
	Scandium	223	NA
	Calcium	19,867	NA
	Potassium	8,247	NA
B-4 (0-6 in.)	Silver	22	300
	Strontium	103	4,000
	Rubidium	39	NA
	Lead	21	400
	Zinc	683	20,000
	Nickel	72	1,000
	Iron	15,262	NA
	Manganese	863	3,000
	Vanadium	75	200
	Titanium	2,176	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
B-4 (0-6 in.)	Scandium	307	NA
	Calcium	35,093	NA
	Potassium	9,028	NA
B-5 (0-6 in.)	Antimony	140	20
	Tin	70	NA
	Cadmium	23	10
	Silver	26	300
	Strontium	85	4,000
	Rubidium	32	NA
	Lead	11	400
	Arsenic	8	20
	Zinc	1,260	20,000
	Copper	62	500
	Iron	17,748	NA
	Manganese	667	3,000
	Chromium	38	200
	Vanadium	58	200
	Titanium	1,389	NA
	Scandium	275	NA
	Calcium	21,208	NA
	Potassium	6,111	NA
B-6 (0-6 in.)	Strontium	92	4,000
	Rubidium	43	NA
	Lead	14	400
	Zinc	134	20,000
	Iron	13,109	NA
	Manganese	430	3,000
	Vanadium	49	200
	Titanium	1,541	NA
	Scandium	200	NA
	Calcium	18,906	NA
	Potassium	6,712	NA
B-7 (0-6 in.)	Strontium	80	4,000
	Rubidium	45	NA
	Lead	32	400
	Zinc	974	20,000
	Iron	14,801	NA
	Manganese	192	3,000
	Vanadium	80	200
	Titanium	2,404	NA
	Scandium	177	NA
	Calcium	14,972	NA
	Potassium	9,706	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
B-8 (0-6 in.)	Antimony	112	20
	Tin	57	NA
	Silver	84	300
	Strontium	179	4,000
	Rubidium	37	NA
	Lead	13	400
	Zinc	66	20,000
	Copper	45	500
	Iron	20,208	NA
	Manganese	628	3,000
	Vanadium	47	200
	Titanium	1,398	NA
	Scandium	410	NA
	Calcium	43,805	NA
	Potassium	6,779	NA
B-9 (0-6 in.)	Silver	30	300
	Strontium	130	4,000
	Rubidium	45	NA
	Lead	19	400
	Arsenic	10	20
	Zinc	117	20,000
	Nickel	90	1,000
	Iron	18,639	NA
	Manganese	777	3,000
	Vanadium	46	200
	Titanium	1,375	NA
	Scandium	283	NA
	Calcium	30,496	NA
	Potassium	7,553	NA
B-15 (0-6 in.)	Strontium	110	4,000
	Rubidium	34	NA
	Lead	12	400
	Zinc	260	20,000
	Iron	16,965	NA
	Manganese	613	3,000
	Chromium	45	200
	Vanadium	56	200
	Titanium	1,545	NA
	Scandium	255	NA
	Calcium	27,942	NA
	Potassium	8,010	NA
C-1 (0-6 in.)	Silver	30	300
	Strontium	129	4,000
	Rubidium	37	NA
	Lead	45	400

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
C-1 (0-6 in.)	Zinc	134	20,000
	Iron	14,229	NA
	Manganese	570	3,000
	Vanadium	38	200
	Titanium	1,159	NA
	Scandium	460	NA
	Calcium	47,784	NA
	Potassium	7,426	NA
C-2 (0-6 in.)	Strontium	127	4,000
	Rubidium	49	NA
	Lead	23	400
	Zinc	96	20,000
	Iron	17,429	NA
	Manganese	711	3,000
	Vanadium	56	200
	Titanium	2,035	NA
	Scandium	280	NA
	Calcium	27,213	NA
	Potassium	9,932	NA
C-3 (0-6 in.)	Strontium	114	4,000
	Rubidium	34	NA
	Lead	13	400
	Zinc	380	20,000
	Iron	14,061	NA
	Manganese	553	3,000
	Vanadium	55	200
	Titanium	1,388	NA
	Scandium	398	NA
	Calcium	42,733	NA
	Potassium	8,048	NA
C-4 (0-6 in.)	Strontium	93	4,000
	Rubidium	41	NA
	Lead	22	400
	Zinc	97	20,000
	Nickel	77	1,000
	Iron	14,317	NA
	Manganese	538	3,000
	Vanadium	48	200
	Titanium	1,784	NA
	Scandium	143	NA
	Calcium	18,084	NA
	Potassium	8,097	NA
C-5 (0-6 in.)	Antimony	73	20
	Silver	29	300

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)

C-5 (0-6 in.)	Strontium	114	4,000
	Rubidium	33	NA
	Zinc	76	20,000
	Iron	14,698	NA
	Manganese	482	3,000
	Vanadium	42	200
	Titanium	1,246	NA
	Scandium	238	NA
	Calcium	32,419	NA
	Potassium	6,742	NA
C-7 (0-6 in.)	Strontium	111	4,000
	Rubidium	20	NA
	Lead	19	400
	Zinc	188	20,000
	Iron	8,660	NA
	Manganese	407	3,000
	Vanadium	33	200
	Titanium	742	NA
	Scandium	838	NA
	Calcium	98,595	NA
	Potassium	6,769	NA
C-8 (0-6 in.)	Antimony	93	20
	Silver	66	300
	Strontium	141	4,000
	Rubidium	12	NA
	Lead	27	400
	Zinc	112	20,000
	Nickel	81	1,000
	Iron	5,508	NA
	Manganese	268	3,000
	Vanadium	22	200
	Scandium	1,312	NA
	Calcium	166,960	NA
	Potassium	3,648	NA
C-9 (0-6 in.)	Strontium	126	4,000
	Rubidium	32	NA
	Lead	14	400
	Zinc	1,198	20,000
	Iron	14,540	NA
	Manganese	481	3,000
	Vanadium	54	200
	Titanium	1,317	NA
	Scandium	402	NA
	Calcium	43,280	NA
	Potassium	6,939	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)

C-14 (0-6 in.)	Antimony	133	20
	Silver	82	300
	Strontium	140	4,000
	Rubidium	42	NA
	Lead	13	400
	Arsenic	10	20
	Zinc	103	20,000
	Nickel	84	1,000
	Iron	18,279	NA
	Manganese	666	3,000
	Vanadium	42	200
	Titanium	1,255	NA
	Scandium	281	NA
	Calcium	36,972	NA
	Potassium	8,227	NA
C-15 (0-6 in.)	Strontium	137	4,000
	Rubidium	45	NA
	Lead	12	400
	Arsenic	9	20
	Zinc	78	20,000
	Iron	18,259	NA
	Manganese	809	3,000
	Vanadium	56	200
	Titanium	1,871	NA
	Scandium	168	NA
	Calcium	15,077	NA
	Potassium	9,030	NA
D-14 (0-6in.)	Strontium	107	4,000
	Rubidium	37	NA
	Lead	24	400
	Zinc	354	20,000
	Copper	52	500
	Iron	17,477	NA
	Manganese	731	3,000
	Vanadium	46	200
	Titanium	1,715	NA
	Scandium	260	NA
	Calcium	30,809	NA
	Potassium	8,107	NA
E-14 (0-6 in.)	Strontium	90	4,000
	Rubidium	29	NA
	Lead	23	400
	Zinc	2,812	20,000
	Copper	61	500
	Iron	17,990	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
E-14 (0-6 in.)	Manganese	529	3,000

	Vanadium	56	200
	Titanium	1,828	NA
	Scandium	279	NA
	Calcium	34,825	NA
	Potassium	8,870	NA
E-15 (0-6 in.)	Strontium	108	4,000
	Rubidium	44	NA
	Lead	29	400
	Arsenic	9	20
	Zinc	197	20,000
	Copper	61	500
	Iron	20,272	NA
	Manganese	936	3,000
	Vanadium	63	200
	Titanium	2165	NA
	Scandium	151	NA
	Calcium	16,763	NA
	Potassium	10,209	NA
F-14 (0-6 in.)	Antimony	71	20
	Silver	40	300
	Strontium	120	4,000
	Rubidium	31	NA
	Lead	56	400
	Zinc	373	20,000
	Copper	49	500
	Iron	21,766	NA
	Manganese	635	3,000
	Vanadium	38	200
	Titanium	1,174	NA
	Scandium	481	NA
	Calcium	42,727	NA
	Potassium	7,388	NA
F-15 (0-6 in.)	Silver	26	300
	Strontium	88	4,000
	Rubidium	43	NA
	Arsenic	9	20
	Zinc	44	20,000
	Iron	18,481	NA
	Manganese	417	3,000
	Vanadium	60	200
	Titanium	2,700	NA
	Scandium	78	NA
	Calcium	8,169	NA
	Potassium	9,985	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
G-1 (0-6 in.)	Silver	59	300
	Strontium	134	4,000

	Rubidium	17	NA
	Lead	80	400
	Zinc	842	20,000
	Copper	55	500
	Iron	15,795	NA
	Manganese	525	3,000
	Vanadium	23	200
	Titanium	281	NA
	Scandium	1086	NA
	Calcium	125,138	NA
	Potassium	5,297	NA
G-2 (0-6 in.)	Antimony	119	20
	Tin	72	20,000
	Silver	57	300
	Strontium	127	4,000
	Rubidium	17	NA
	Lead	70	400
	Zinc	664	20,000
	Iron	13,035	NA
	Manganese	365	3,000
	Vanadium	16	200
	Titanium	358	NA
	Scandium	726	NA
	Calcium	110,422	NA
	Potassium		NA
G-3 (0-6 in.)	Antimony	130	20
	Tin	73	20,000
	Silver	109	300
	Strontium	133	4,000
	Rubidium	16	NA
	Lead	66	400
	Zinc	599	20,000
	Iron	9,425	NA
	Manganese	337	3,000
	Vanadium	27	200
	Titanium	87	NA
	Scandium	1,503	NA
	Calcium	172,309	NA
	Potassium	6,097	NA
G-4 (0-6 in.)	Antimony	57	20
	Silver	33	300
	Strontium	125	4,000
	Rubidium	43	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
G-4 (0-6 in.)	Lead	15	400
	Zinc	58	20,000
	Copper	44	500

	Iron	18,536	NA
	Manganese	457	3,000
	Vanadium	52	200
	Titanium	2,059	NA
	Scandium	221	NA
	Calcium	21,298	NA
	Potassium	9,718	NA
G-6 (0-6 in.)	Strontium	121	4,000
	Rubidium	21	NA
	Lead	21	400
	Arsenic	16	20
	Zinc	332	20,000
	Iron	10,062	NA
	Manganese	343	3,000
	Vanadium	28	200
	Titanium	528	NA
	Scandium	969	NA
	Calcium	118,434	NA
	Potassium	5,988	NA
G-7 (0-6 in.)	Strontium	125	4,000
	Rubidium	25	NA
	Lead	35	400
	Zinc	461	20,000
	Iron	14,804	NA
	Manganese	551	3,000
	Vanadium	36	200
	Titanium	933	NA
	Scandium	579	NA
	Calcium	92,602	NA
	Potassium	6,845	NA
G-8 (0-6 in.)	Strontium	168	4,000
	Rubidium	33	NA
	Lead	26	400
	Zinc	265	20,000
	Iron	28,155	NA
	Manganese	764	3,000
	Vanadium	40	200
	Titanium	1,427	NA
	Scandium	422	NA
	Calcium	75,207	NA
	Potassium	10,009	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
G-9 (0-6 in.)	Silver	45	300
	Strontium	149	4,000
	Rubidium	37	NA
	Lead	33	400

	Zinc	537	20,000
	Iron	20,984	NA
	Manganese	747	3,000
	Vanadium	43	200
	Titanium	1,354	NA
	Scandium	498	NA
	Calcium	53,194	NA
	Potassium	9,489	NA
G-11 (0-6 in.)	Antimony	110	20
	Silver	55	300
	Strontium	130	4,000
	Rubidium	41	NA
	Lead	33	400
	Zinc	367	20,000
	Iron	17,734	NA
	Manganese	589	3,000
	Vanadium	46	200
	Titanium	1733	NA
	Scandium	345	NA
	Calcium	34,004	NA
	Potassium	9,131	NA
G-12 (0-6 in.)	Silver	23	300
	Strontium	104	4,000
	Rubidium	38	NA
	Lead	48	400
	Arsenic	11	20
	Zinc	680	20,000
	Nickel	67	1,000
	Iron	18,690	NA
	Manganese	689	3,000
	Vanadium	49	200
	Titanium	1,855	NA
	Scandium	227	NA
	Calcium	31,015	NA
	Potassium	10,256	NA

NA means there is no applicable comparison value for that particular chemical parameter.

Table A-1 (Cont.) – Site Soil Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (mg/kg)	Comparison Value (mg/kg)
G-14 (0-6 in.)	Antimony	108	20
	Tin	54	20,000
	Silver	69	300
	Strontium	145	4,000
	Rubidium	32	NA
	Lead	134	400
	Zinc	921	20,000
	Nickel	108	1,000
	Iron	17,227	NA
	Manganese	712	3,000
	Vanadium	36	200
	Titanium	1,033	NA
	Scandium	545	NA
	Calcium	64,825	NA
	Potassium	7,806	NA
BSS-1 (0-6 in.)	Antimony	88	20
	Silver	35	300
	Strontium	122	4,000
	Rubidium	46	NA
	Arsenic	16	20
	Zinc	83	20,000
	Iron	16,342	NA
	Manganese	425	3,000
	Vanadium	38	200
	Titanium	1,199	NA
	Scandium	83	NA
	Calcium	9,683	NA
	Potassium	5,503	NA
FTBS (0-6 in.)	Antimony	85	20
	Silver	80	300
	Strontium	212	4,000
	Rubidium	15	NA
	Zinc	85	20,000
	Nickel	88	1,000
	Iron	7,411	NA
	Manganese	352	3,000
	Vanadium	40	200
	Titanium	198	NA
	Scandium	1,587	NA
	Calcium	170,380	NA
	Potassium	5,596	NA

NA means there is no applicable comparison value for that particular chemical parameter

Table A-2 – Site Groundwater Analysis (1)

Sample ID (Depth)	Chemical Parameter	Concentration (µg/L)	Comparison Value (µg/L)
MW-2	Vinyl Chloride	2.7	2
	Trans 1,2 Dichloroethene	2.8	100
	Benzene	1.5	5
GP-2	Metyl tert-Butyl Ether	4.1	20
	Cis 1,2 Dichloroethene	2.4	70
GP-2 Duplicate	Cis 1,2 Dichloroethene	3.5	70
GP-2 Rinsate	Metyl tert-Butyl Ether	4.1	20
	Cis 1,2 Dichloroethene	3.2	70